Getting Beyond the Surface.

Using Geometric Data Analysis in Cultural Sociology.

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Chapter to appear in Hanquinet, Laurie & Mike Savage (eds.), *Handbook of the Sociology of Art and Culture*, London: Routledge.

Abstract

Geometric Data Analysis (GDA) refers to a group of statistical techniques that disclose underlying patterns in categorized data. GDA represents categories of variables and individuals as points in a multi-dimensional Euclidean space. This contribution presents some of GDA's analytic properties and their connection to a relational approach of the social world. Moreover, the potential of GDA for cultural sociology will be discussed. What does GDA add to insights based on 'orthodox' correlational techniques and exactly how does it get beyond the surface of things? Research on the association between cultural consumption and socio-economic background will serve as an illustration.

1. Introduction

Correspondence analysis is "a relational technique of data analysis whose philosophy corresponds exactly to what, in my view, the reality of the social world is. It is a technique which 'thinks' in terms of relation, as I try to do

precisely with the notion of field." (Bourdieu and Wacquant, 1996: 96). This quotation from the French sociologist Pierre Bourdieu is often invoked as an argument to veer away from traditional correlational techniques like multivariate regression analysis and to opt for Geometric Data Analysis (GDA) as statistical toolbox—away from 'general linear reality', which centres on dependent and independent variables with a focus on causality and usually assumes causal attributes to be independent from one another (see Abbott, 1988). GDA refers to a group of techniques including for example Correspondence Analysis (CA) that use spatial measures like Euclidean distance and dispersion along principal axes to analyse, describe and visualise large datasets (for good technical introductions and more, see for example Benzécri, 1992; Greenacre, 2007; Le Roux & Rouanet, 2004; 2010; Murtagh, 2005; Tenenhaus & Young, 1985). Outcomes of GDA are clouds of points in a geometric space—just like numbers are the outcome of standard regression procedures.

The aim of this article is to elaborate and think about GDA as a technique that 'thinks in terms of relations' and show what it can add to the use of traditional regression based techniques. I do not mean to downplay the importance of regression analysis—I am a happy user of regression techniques myself. Rather I want to highlight the potential of GDA and explain the way it can be linked to relational thinking. Hereto, I use an example I am fairly familiar with and which very much parallels the analyses presented by Bourdieu in *Distinction* (1984), *i.e.* an analysis of the social structuring of cultural practices. What is the relationship between class and taste as an attempt to re-think Weber's classical opposition between 'Klasse' and 'Stand'?

2. Multiple Correspondence Analysis

2.1. Basic ideas

The basic rationale in GDA is not to isolate 'independent' or 'dependent' variables, but to explore and visualize complex relations between variables and categories of variables—called 'modalities'—that are 'hidden' in the data. Correspondence Analysis (CA) is one of the most popular and powerful tools within the GDA toolbox and is used to detect latent structuring principles comparable to Principal Component Analysis, be it that CA deals with categorical variables. The basics of Multiple Correspondence Analysis (MCA), the multivariate variant of CA, can be linked to relational reasoning à la Bourdieu, as it tries to unravel and visualize the objective system of positions grounded in the distribution of resources and the subjective 'lived' social life of different actors framed by that

system and their position within it (Mohr, 1998; 2000). *E.g.* Bourdieu distinguishes a space of positions with aggregation points of capital and a space of position-takings, "*i.e.*, the structured system of practices and expressions of agents" (Bourdieu and Wacquant, 1992: 105). Bourdieu assumes a relation of homology between these two spaces, in the sense that position-takings relate to each other in a way that is homologous to how positions relate to each other.

The nature of a field is inherently historical: the field and its dimensionality are the result of diachronic struggles which remain entrenched in any cross-sectional image of it—struggles over what is good/bad, over what practices are worthy/unworthy, *etc*. Conflicts are central. The field logic forces you to think in oppositions: certain practices for example do not have significance in and of their own, but in relation/contrast to other practices. The analysis evolves not so much about whether or not people attend an opera for example, and what characteristics are related to opera attendance—like a regression analysis would do. In MCA, opera attendance is considered in relation to attending rock concerts, visiting museums or Chinese restaurants, doing sports for the kick, or liking Flemish Primitives paintings. Practices are seen in the context of other, (dis)similar practices—not only determined by their attributes, but also by their position vis-à-vis other activities in the field. So, MCA is a relational method à la De Saussure: cultural activities are not to be considered *per se*, but in relation to other cultural activities—within the field of cultural practices, objects and dispositions. And it is these patterns of activities that are linked up with the relative possession of a certain type of capital associated with privileges, power, and success.

Next to the cloud of modalities, there is the cloud of individuals that projects each individual onto the same Euclidean space. This is one of the unique properties of MCA: it simultaneously visualizes variables as well as individuals. So, it generates both variable-centred as well as individual-centred analyses. It should be noted however, that MCA creates a system of objective relations between individuals, no real interpersonal networks (*cf*. Bourdieu & Wacquant, 1992: 97; De Nooij, 2003). Individuals are dispersed within the Euclidean space, their distance reflecting dissimilarity with regard to mental, embodied structures, dispositions and practices as well as to the 'objective' power resources/restraints—not necessarily reflecting any real social connection/contact. This is what the 'magical eye' of GDA succeeds in (Rosenlund, 1995): MCA bridges subjective meanings/consciousness of actors with 'hidden' objective power structures. In other words, it discloses the invisible power relationships to an untrained eye, because 'they are obscured by the realities of ordinary experience' (Bourdieu, 1984: 22) and relates

them to individuals' common everyday assumptions and ideas rooted in practicality of social life. Of course, also regression analysis is able to relate 'hidden' structural variables to practices, but the strength of GDA is situated in the comprehensive way it discloses latent patterns in the data, without relying all too heavily on the choice of specific manifest variables.

2.2. Illustration: Cultural practices/dispositions and social position

A social field in Bourdieusian terms is a snapshot of processes of contestation and redefinition about what activities are valuable or worthwhile endorsing, what cultural practices/dispositions are superior and for whom. Within the social space you can see different and differing oppositions at work—in *Distinction* (1984) Bourdieu finds cultural lifestyle to be structured along capital volume and capital composition. Using data from the survey 'Cultural participation in Flanders 2003-2004', a large-scale survey conducted among a representative sample of the Flemish population (*n* = 2,849), I analyse how the field of cultural practices in Flanders *anno* 2000 is structured. What dimensions are central in making up the space of lifestyles? Hereto, I use 64 variables—no sparseness problems with MCA as any number of variables can be entered—that can be subdivided into two groups (for a more comprehensive description of the analysis, see Roose *et al*., 2012). Firstly, there is the participation variables that include cultural activities ranging from lowbrow to highbrow and situated both in the public as well as the private sphere, such as watching television, going to the movies, reading comics, going to a restaurant, traveling, doing sports, *etc*. Secondly, there is a group of variables that focus on the ways people do things, attempting to get at the dispositional aspects of cultural behaviour, like, for example, motives for traveling, expectations towards movies, attitudes towards what's good food, preferences in the fine arts, *etc*. Variables in the first group are dichotomous, in the second group they have three categories: 'like', 'neutral' and 'dislike' or 'agree', 'neither agree/nor disagree' and 'disagree' (see Table A1 and Table A2 in Appendix for an overview of the variables used in the global space).

Three axes or dimensions turn out to be essential in making up the global social space in Flanders—these axes are similar to comparable studies using MCA in the UK (Bennett *et al*., 2009), Denmark (Prieur, Rosenlund & Skjott-Larsen, 2008) and Serbia (Cvetičanin & Popescu, 2011). The first dimension is an engagement-disengagement axis contrasting an active, outward-oriented lifestyle with a more domestic and passive leisure pattern. This opposition

in behaviour is related to attitudes opposing openness to new things versus an orientation favouring the familiar, things that have proven their use/quality. Dimension two opposes a preference for action, adventure and thrills versus a more contemplative, reflective lifestyle with a taste for consecrated or legitimate forms of culture. The third axis depicts again an openness to new things versus a neutral stance towards openness. This openness is a dispositional characteristic applicable to a variety of domains—for example, sport, movies, travel, and food. Axis one and two are related to indicators of social position. Axis one is associated with educational credentials and cultural participation of the parents, dimension two is linked up with age, an indicator of life phase or birth cohort. Axis three is linked to a combination of characteristics, which I will return to in paragraph 3.

TABLE 1 ABOUT HERE

GRAPH 1 ABOUT HERE

Let me show in detail how exactly the sociological interpretation of the axes develops. The total variance of the contingency table, called inertia in GDA, is decomposed along principal axes using Singular Value Decomposition (SVD). Each variable/modality contributes to the principal inertia or the variation within each dimension—the variation of all dimensions sums up to the total inertia. Based on this SVD one decides on the number of axes to interpret—here: three, a decision corroborated by the modified inertia rates (Benzécri, 1992: 412). These rates are better indicators for the relative importance of the various dimensions than the raw inertia rates that tend to underestimate the relative importance of the first axes. Now, the relative contributions show what variables are responsible for the variation along an axis. So, higher contributions should be given more weight in explaining the 'sociological' meaning of a dimension. For example, Table 1 shows the contributions of all variables and modalities higher than the average contribution for the second axis (for variables this average contribution equals 1/64 (1.56%) or the number of variables, for modalities this is 1/173 (0.57%) or the number of active categories). As you can see in Table 1, the items are ordered from the highest to the lowest relative contribution (from 6.74% to 1.45%). The variables shown are good for 78.30% of the variation in the second axis. Indicators of taste in the fine arts are most distinctive: (dis)liking Flemish primitives (6.74%), baroque portraits (6.64%), renaissance paintings

(5.69%) and listening to classical music (4.52%) are the four most important items differentiating the left from the right pole of the dimension (see Graph1 on the left for the cloud of modalities contributing more than average to the second axis). The lower side of the graph depicts modalities showing a manifest dislike for the fine arts combined with a preference for partying, adventure when on holidays, liking movies with action, adventure and violent scenes and listening to dance music. The upper side shows items indicating a preference for highbrow arts, opera and classical music. The opposition between being disposed towards a preference for action and adventure versus contemplating the consecrated fine arts is corroborated by the other items, such as the type of television channel watched or the motives to do sports. Thus, the interpretation of the dimension is based on a whole series of indicators and so, has a tendency not to be biased too much by changes in manifested preferences or the use of specific items that may have changing meanings over time and undermine comparability. The same rationale holds for the interpretation of axis one and three. In that way, the active variables create a space of different global oppositions.

Of course, this space is mute on the power resources these oppositions are related to—they merely signal 'position-takings' and no 'positions' (Bourdieu & Wacquant, 1996: 105). With MCA it is possible to include so-called supplementary variables that do not contribute to the construction of the space, but which can be added as illustrative points to see what variables the dimensions of the space is associated with—usually characteristics like educational attainment, occupational category, gender, *etc.* are used and plotted into the space. This is what GDA calls 'structured analysis': using the between- and within-variance of variables GDA explores the associations with the axes making up the space. Table 2 and the right graph on Graph 1 both show how age is related to the dimensions in the global space. In Table 2 the decomposition of variance of the individuals along the axes in terms of age is presented. The between-age variance divided by the total variance equals η^2. η^2 is comparable to R^2 in regression analysis: 29.0% of the variance in the second dimension can be attributed to age, for axis one this amounts to some 20%. Indeed, the age categories [14-17] and [18-24] are situated at the bottom on Graph 2, while [55,74] and [75-85] are plotted at the top. This means that the contemplative, *Bildung*-oriented lifestyle is disproportionately situated among the higher age groups, while the active, adventurous and kick-seeking disposition is relatively more common among youngsters.

The same graph also shows that—not surprisingly—higher education (HE) is associated with a preference for highbrow practices, while a high school degree or lower secondary education (LSE) is more common among the adventurous practices—be it that the last association is quite small considering the relatively small distance from the origin. I also plotted the EGP-class scheme as a supplementary variable in Graph 1 and it generates similar findings: those in managerial occupations and professions are more prone to prefer legitimate cultural forms than people in routine occupations. This analysis underlines that the opposition between highbrow and lowbrow culture is still very relevant—the association with age may hint at an association with generation-based differentiation in manifestations of cultural capital (*cf*. Bellavance, 2008).

It is clear that the idea of controlling for certain 'confounding' variables—and the assumption of linearity—central to multivariate regression analysis is absent in MCA. For some, this counts as a serious drawback. Yet, this reluctance to think in terms of independent and dependent variables, of having to control for 'confounding' characteristics, is founded on the 'illusion of constancy' (Bourdieu, 1984: 18): it is not because the number of years of education are the same for men and women in 'statistical' terms, for city-dwellers versus people from the country, for members of the well-to-do bourgeoisie versus workers for example, that the sociological significance of these educational careers is similar. One runs the risk of 'lumping together' very different experiences—just for the sake of statistical metric. Usually, in regression analysis, the solution for incorporating these interrelations between different variables is the use of interaction-effects, but when three or more variables are involved in these interactions, an easy way of interpreting these interrelationships becomes improbable.

3. Clustering techniques: hierarchical agglomerative clustering

Using the individual scores on the dimensions of the space, it is possible to try to find meaningful clusters within the space—this is what I have done to try to get at the type of individuals scoring high on axis three—the dimension indicating openness to a variety of practices. At first sight, the third axis turns out to be somewhat enigmatic as it is related neither to educational attainment, age nor gender, but perhaps it is associated with a specific combination of values on these variables? This example shows how GDA can produce that 'network of structures' I mentioned above. Would it be possible to find a segment within the population scoring high on openness resembling the typical omnivore, who is supposed to be relatively young, highly educated and belongs to

the (upper-)middle classes? Could also other segments be detected, scoring equally high on openness, but showing it in a totally different way than these 'traditional' omnivores?

GRAPH 2 ABOUT HERE

Using the scores on all dimensions of the global space, I performed a hierarchical clustering using 'nearest neighbour' as criterion for segmentation. This generated an agglomeration tree which suggests a cut at seven segments. Three of these segments—each characterized by a specific combinations of factors—score high on dimension three. Graph 2 plots them in plane 1-3: you can see they all score high on the third dimension (their modality mean points are situated above the origin) and differ along the first dimension, an indicator of overall possession of cultural capital. By comparing the relative frequencies of variables between segments and sample, it is possible to describe these clusters in terms of 'distinctive' variables. Briefly, they are (1) middle-aged managers and professionals with high schooling levels and a lot of cultural capital—they could be considered as prototypical examples of the omnivore: relatively young, highly educated and having a high social position (Peterson, 1992); (2) Youngsters and students with less cultural capital but a strong predilection for amusement and action, and (3) Older people (aged 65+) with relatively little cultural capital but a strong interest in classical, figurative art and cultural TV programs. So, openness—this is what the third dimension stands for—is manifested in totally different ways, the first being omnivorousness as it is usually conceived in the literature. The other two segments also score high on openness, but it manifests itself in different practices depending on generation—at least this is how the effect is interpreted in Roose *et al*. (2012). This is a clear illustration of how an underlying tendency may have behaviorally different manifestations according to someone's cultural capital—and/or the generation one belongs to—empirical findings that would not easily be discovered using correlational techniques only as they would be hampered by sparseness issues and difficulties in handling combinations of categorical variables.

4. Class-Specific Analysis

Whereas clustering techniques allow you to go beyond general linear reality in the global space—they focus on specific combinations of values on variables to account for the dimensions in cultural practices—Class-Specific

Analysis goes one step further. The global dimensions disclosed by MCA may conceal logics and principles of distinction that are confined to certain localities within the social space, restricted for example to a certain social segment or occupational categories. Class-Specific Analysis (CSA) allows to explore these localised logics that may be traces of some of the contestations that have taken place over time within the field. With CSA it is possible to analyse if and to what extent oppositions and distinctions within specific subpopulations are similar to the dimensionality of the general population. For example, are the same kind of cultural activities as distinctive for the young as they are for older individuals? When trying to get at what activities and dispositions generate distance between individuals within a specific sub-group or segment of the population, focus on the oppositions in the global space loses significance and relevance. It is the distances and the principal components making up the restricted sub-space that become of interest if you want to unravel the structuring dimensions of each cluster—be it with reference to the global cloud (Le Roux & Rouanet, 2010: 61-69).

CSA looks for principal dimensions within a sub-cloud—say for example for the elderly, or managers, or women—without 'extracting' it from the global space. CSA resonates with Mohr's critique on linearity of axes reflecting capital. He argues—and perhaps rightly so—that within the concept of field only the global oppositions are taken into account to relate social positions to practices and that "[o]ther conflicts, other engagements and, especially, more localised struggles over resources and positions are not taken into account in this mode." (Mohr, forthcoming). It may give you an idea of the conflicts over what is worth struggling for.

As an illustration I will use CSA to explore the possibly different structuring principles for the young and the elderly as part of an investigation of so-called emerging cultural capital (Prieur & Savage, 2013; Savage & Hanquinet, forthcoming). This new form of capital is considered to be the prerogative of the young, championing a screen-based, Anglo-cosmopolitan commercial culture that is appropriated with a certain ironical stance versus the Eurocentric, cerebral, ascetic and serious highbrow culture. There is growing evidence that the specific content of cultural capital is being contested. For example, working class respondents in the UK claim not to be "in awe of legitimate culture and find no value in refinement" (Bennett *et al.*, 2009: 205), neither is there "a deference towards legitimate culture" (*ibid*.: 212). What is consecrated may not have universal legitimacy and different forms of 'capital' may be at work simultaneously. So, do you find traces of this 'emerging cultural capital' structuring the sub-cloud of the young?

*** GRAPH 3 ABOUT HERE***

Graph 3 shows the clouds of individuals of two sub-segments within the global space, the young (-25) on the left and the elderly (55+) on the right. You can see that both sub-clouds are situated in different parts of the global space: the young in the South-West quadrant, the older individuals positioned North-East—they are more disengaged and inclined to highbrow, legitimate cultural forms while shunning action and adventure. As for the dispersion of the individuals, the young are scattered both along axis one and two, the elderly more along axis two.

CSA starts off with a PCA of all global structuring dimensions obtained from the Specific MCA for the sub-clouds only.[i] When you compare the correlations of the dimensions of the sub-clouds with the axes in the global space, you can see interesting differences. The sub-space of the 55+ is similarly structured as the global space: the correlation coefficients between their first axes is 0.97 ($p < 0.001$), for the second axes this is 0.72 ($p < 0.001$). This picture is somewhat different for the -24: the correlations are respectively 0.31 and 0.72, suggesting that the first dimension for the young is differently structured than the first axis in the global space. Graphs 4 and 5 together with Tables 3 and 4 contain the results of the two CSA's and allow for a thorough analysis of similarities and differences.

GRAPH 4 ABOUT HERE

TABLE 3 ABOUT HERE

In Table 3 you can see the modalities that contribute more than average in the orientation of the first and second dimension for the young—these contributions are graphically represented in Graph 4. For axis one, it is especially a preference for screen-based action, fun and adventure and an outright rejection of the fine arts that stand opposed to a neutral attitude towards fine arts (*e.g.* Flemish primitives, renaissance paintings, baroque portraits, (post-)impressionism) or other more contemplative things, like listening to chanson or classical music.

Also watching musical and commercial television channels (MTV, TMF, VT4 and KA2) work as a distinguishing forces. At the time, these channels aired music videos, reality shows like *Big Brother*, sitcoms like *Friends* and a lot of recent action movies. Axis two opposes a neutral attitude with a disposition towards an active lifestyle indicated by doing sport for the kick, wanting to change one's limits and to get a beautiful body and adventurous travel with backpack to meet new people or explore other cultures. Here, a sportive disposition is supplemented with some sort of openness towards new things, a sociable attitude towards the 'other' in terms of travel. This openness also seems to manifest itself through a preference for avant-garde art, like abstract expressionism, surrealism and Dada or listening to jazz—without a devotion for more consecrated forms of art which is the case in the global space. The love of art in the global space encompasses all genres with the older, canonised, figurative streams as being more important in the orientation of the second dimension than the more recent and more difficult 'abstract' forms.

GRAPH 5 ABOUT HERE

TABLE 4 ABOUT HERE

Table 4 and Graph 5 show that, for the sub-space of the 55+ segment, axis one distinguishes an out-of-the-house, active lifestyle with concert attendance, museum visits, travel and sport activities with a more passive, home-bound disposition centred around watching commercial television and 'eating at home is the best there is'. With the elderly engagement is manifested through culture and traveling, less through going to the movies, shopping or going to a pub. The second axis for the 55+ contrasts a preference for consecrated art forms such as impressionism, baroque portraits as well as more contemporary streams (surrealism and abstract expressionism) with a neutral stance—while in the global space these aesthetic preferences are opposed to an outright rejection. Contrary to the younger age groups, consecrated, figurative art and more avant-garde art go hand in hand, and co-exist as status marker. For the young a preference for avant-garde art runs parallel with an active, adventurous way of living contrasted with a neutral attitude.

So, CSA shows empirically that the fine arts stand out as distinguishing practices both for the elderly and the young—be it in interestingly different ways. Preferences for people born before 1950 are very much characterised by a deference and no real dislike *vis-à-vis* legitimate culture. Liking legitimate culture signals openness, a wish to be confronted with new experiences. For people born after 1980 this is different: legitimate art is less central as a distinctive force—at least, if it turns out to be structuring the sub-cloud, it is as something that is disliked versus indifferent to (*cf*. the dislike for impressionism, late-renaissance/baroque, baroque portraits, Flemish primitives on dimension one). Apparently, younger people are not in awe for 'classical' fine arts—perhaps they consider them 'stained' or old-fashioned—, while abstract expressionism, Dada, abstract art and surrealism are part of an underlying adventurous, open attitude.

Thus, CSA is able to show how legitimate culture means different things to different people, reminiscent of the different ways—the how—art works are appropriated. And likewise, the potential for social distinction of the same practices may differ depending on the social circles where they are deployed. So, it is not only other activities that form part of a possible change in the manifested preferences/dispositions/practices related to cultural capital (Prieur & Savage, 2013), but also different ways of appropriating similar activities. This questions the idea of a societal and universally deployable symbolic meaning of cultural activities in terms of social distinction: *e.g.* the inter-generational difference of the meaning of the fine arts as indicator of openness for the elderly versus a sign of an old-fashioned nature or something *passé* for the young. I think that with the development of CSA, GDA allows researchers to get beyond the surface of things—and arrive at findings that add to insights grounded in correlational techniques.

5. Conclusion

In this contribution I wanted to highlight the potential and applicability of GDA within cultural sociology. The strengths of GDA can be found in its ability to include a lot of variables to produce a fine-grained detailed picture, its simultaneous handling of variables and individuals, and its close connection with relational thinking. Using spatial measures and graphical representations it provides attractive visual tools to summarize huge data-matrices in relatively easy-to-interpret graphs. With the illustrations I showed how MCA can disclose latent patterns from large datasets, how these patterns can be investigated through their associations with socio-economic and other

variables, how also specific combinations of variables can be related to the dimensions via hierarchical cluster analysis and finally how different/differing principles of opposition can be at work simultaneously and disclosed by means of CSA.

Of course, GDA is not without its critics—and justly so. Tony Bennett for example (2007: 214), argues that the polarizing logic is "partly a reflection of the ways in which multiple correspondence analysis converts cultural data into binary opposites which do not allow fine graded distinctions to be taken into account and which, if not guarded against, exaggerate differences at the expense of shared taste." Indeed, the input for GDA is best served with dichotomous variables. Likert-scale items tend to produce the so-called horseshoe-effect or Guttman-effect, in which extreme answers ('strongly agree', strongly disagree') are opposed to the neutral categories ('neutral', 'somewhat agree')—from a substantial point of view quite uninteresting. Another standard critique takes charge with GDA's inability to do multivariate controls, which for some analytical purposes prove necessary. However, the strength of GDA is its ability to go beyond the surface of manifest categories and disclose hidden patterns in the data—paths hitherto unexplored by traditional regression analysis. It continues to have 'elective affinity' with the idea of social space/field and the recent developments within the GDA-framework—like hierarchical clustering and CSA—have considerably refined the toolbox making it even more attractive to deploy within cultural sociology.

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Table 1. Relative contributions of variables and modalities to the orientation of axis 2 (in per cent).

Variables	Contribution of variables	Modalities		Contribution of modalities (in %)	
	(in %)	Lower side	Upper side	Lower side	Upper side
Arts: Flemish primitives	6.74	Dislike	Like	3.03	3.67
Arts: baroque portraits	6.64	Dislike	Like	3.18	3.27
Arts: renaissance	5.69	Dislike	Like	2.84	2.72
Listening to classical music	4.52	Never	Often	1.46	2.73
Arts: (post-)impressionism	4.25	Dislike	Like	1.67	2.51
Travel: party	3.91	Agree	Disagree	1.96	1.91
Listening to opera	3.83	Once/while	Often	2.03	1.13
Film: violent scenes	3.63	Like	Dislike	1.15	1.33
Travel: visit culture	3.10	Disagree	Agree	1.20	1.88
Travel: adventure	3.05	Agree	Disagree	1.20	1.79
Film: action & adventure	2.86	Like	Dislike	1.29	1.52
Listening to dance	2.70	Often	Never	1.44	1.25
Visiting museums of fine arts	2.64	-	Yes	-	2.23
Watching TV: VT4	2.47	Yes	-	2.23	-
Sport: kick	2.21	Agree	Disagree	0.99	0.45
Listening to pop/rock	2.20	Often	Never	0.76	1.44
Watching TV: MTV/TMF	2.05	Yes	-	1.94	-
Travel: sea & beach	2.02	Agree	Disagree	0.83	1.19
Film: special effects	1.96	Like	Dislike	0.90	0.91
Sport: limits	1.86	Agree	Disagree	0.89	0.59
Watching TV: KA2	1.83	Yes	-	1.68	-
Visiting museums cont. arts	1.79	-	Yes	-	1.55
Arts: 19th C landscapes	1.78	Dislike	Like	0.79	0.94
Reading prose/poetry	1.59	No	Yes	0.59	1.00
Arts: surrealism	1.53	-	Like	-	1.08
Watching TV: Canvas	1.45	-	Yes	-	1.20
	78.30			34.05	38.29

Source: adapted from Roose *et al.*, 2012.

Table 2. Coordinates of mean points and variances of age categories on the first three axes (break-down of variance along axes and age).

Age		Mean point coordinates			Variances		
	weight	Axis 1	Axis 2	Axis 3	Axis 1	Axis 2	Axis 3
14-17	209	-0.15	-0.33	-0.08	0.0682	0.0463	0.0875
18-24	323	-0.18	-0.22	-0.04	0.0729	0.0649	0.0689
25-54	1436	-0.07	-0.02	+0.01	0.0952	0.0684	0.0589
55-74	741	+0.19	+0.19	+0.01	0.1240	0.0597	0.0578
75-85	140	+0.45	+0.24	+0.05	0.0576	0.0372	0.0405
				within-Age	0.0962	0.0625	0.0608
				between-Age	0.0283	0.0260	0.0008
				total (λ_i)	0.1245	0.0885	0.0617

Legend: Used transition formula from coordinate of modality to modality mean point = coordinate * SQRT(λ_i);

Variances based on one-way ANOVA on coordinates (*N.B.*: Sum of Squares divided by *n*).

η^2 on axis 1 = 0.23, axis 2 = 0.29 and axis 3 = 0.01 (or between-variance divided by total-variance).

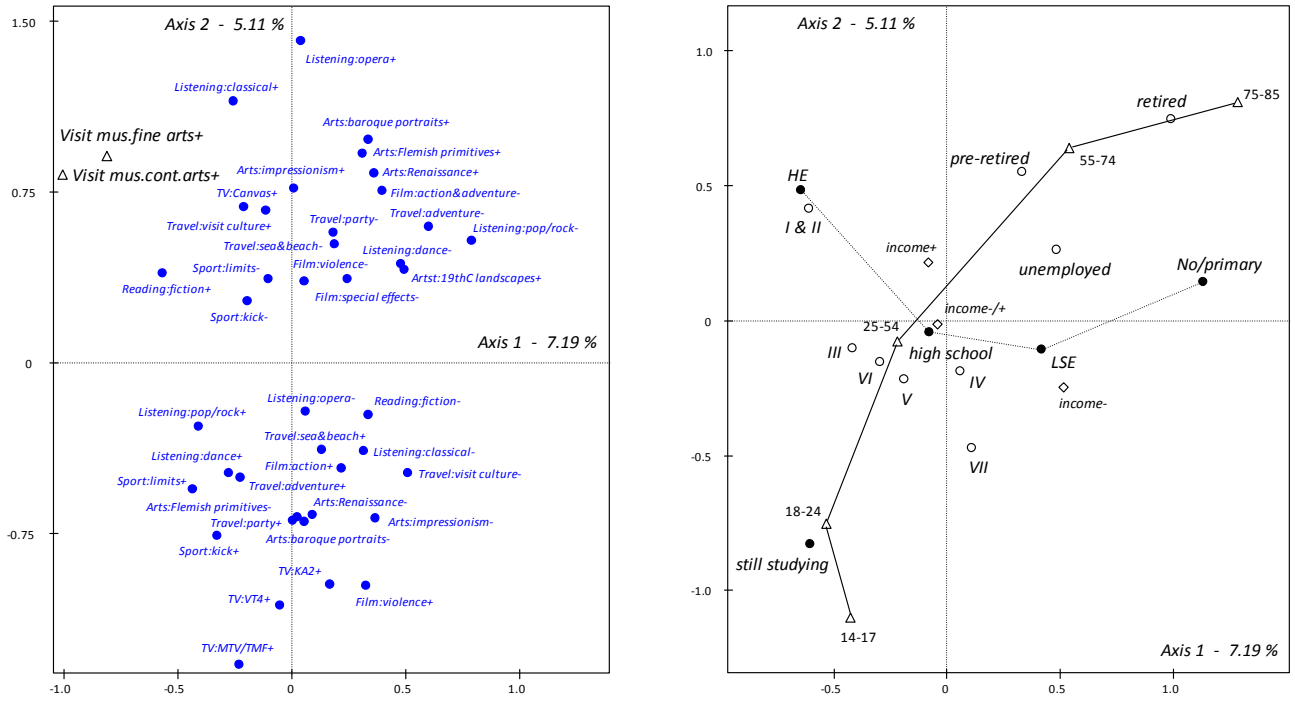
Table 3. Contributions of modalities (in per cent) for first two axes in sub-cloud '14-25 years' (n = 532).

Age: -25 (n = 532)	Contribution of modalities					Contribution of modalities			
Axis 1	Left		Right		Axis 2	Left		Right	
Watching TV: music channel	-	-	Often	9.3	Sport: to change limits	Neutral	2.2	Agree	5.3
Film: contains violent scenes	-	-	Like	5.9	Travel: other cultures	Neutral	1.3	Agree	4.0
Watching TV: VT4	-	-	Often	4.0	Sport: kick	Neutral	0.9	Agree	3.0
Film: uses a lot of special effects	-	-	Like	3.6	Arts: abstract expressionism	-		Like	2.6
Watching TV: KA2	-	-	Often	3.4	Sport: a beautiful body	-		Agree	2.6
Film: contains action & adventure	Neutral	1.4	Like	2.6	Travel: meet new people	-		Agree	2.4
Arts: (post-)impressionism	-	-	Dislike	1.7	Travel: visit culture	Disagree	2.4	-	-
Travel: party and fun	Neutral	1.0	Agree	1.5	Arts: (post-)impressionism	Dislike	2.4	-	-
Arts: late-renaissance/baroque	Neutral	1.3	Dislike	1.5	Arts: surrealism	-	-	Like	2.2
Reading	Yes	1.5	No	0.9	Listening to jazz/blues/soul/funk	Never	1.0	Often	2.2
Travel: sea & beach	-	-	Agree	1.4	Travel: adventure	Neutral	0.8	Agree	2.1
Sport: kick	Neutral	1.1	Agree	1.4	Watching TV: music channel	-		Often	2.0
Film: makes you laugh	Neutral	1.3	Like	1.0	Film: original in form and style	-		Like	2.0
Travel: visit culture	-	-	Disagr	1.3	Travel: hiking and trekking	Neutral	1.3	Agree	1.9
Arts: baroque portraits	Neutral	1.1	Dislike	1.3	Food: try new recipes	Neutral	1.0	Agree	1.9
Sport: a beautiful body	Neutral	1.1	Agree	1.3	Visiting museum contemp. arts	-	-	Yes	1.7
Food: familiar fare	-	-	Agree	1.2	Sport: team spirit	Neutral	1.6	-	-
Arts: Flemish primitives	Neutral	1.0	Dislike	1.1	Arts: abstract art	-	-	Like	1.6
Listening to chanson	Once/wh	0.9	Never	1.1	Film: critical comment on society	-	-	Like	1.4
Listening to classical music	Once/wh	1.1	-	-	Arts: conceptual art/Dadaism	-	-	Like	1.3
Total contribution: 63%		17%		46%	Total contribution: 66%		17%		49%

Table 4. Contributions of modalities (in per cent) for first two axes in sub-cloud'55-85 years' (*n* = 881).

Age: 55-85 (*n* = 881)	Contribution of modalities					Contribution of modalities			
Axis 1	Left		Right		Axis 2	Left		Right	
Going to a restaurant	-	-	No	3.3	Arts: baroque portraits	Neutral	2.4	Like	10.2
Visiting museum fine arts	Yes	3.1	-	-	Arts: late-renaissance/baroque	Neutral	2.1	Like	8.4
Travel: other cultures	Agree	1.0	Disagr	2.5	Arts: Flemish primitives	Neutral	2.7	Like	8.2
Traveling	Yes	0.9	No	2.5	Arts: (post-)impressionism	Neutral	0.9	Like	4.0
Film: original in form and style	-	-	Dislike	2.5	Listening to classical music	-	-	Often	3.9
Food: try new recipes	-	-	Disagr	2.4	Arts: landscapes	Neutral	1.4	Like	2.3
Listening to classical music	Often	2.2	Never	1.3	Film: contains action & adventure	-	-	Dislike	1.7
Food: familiar fare	Disagr	0.9	Agree	2.2	Travel: visit culture	-	-	Agree	1.7
Visiting museum contemp. arts	Yes	2.1	-	-	Travel: party and fun	Neutral	1.1	Disagr	0.9
Shopping	-	-	No	1.8	Arts: abstract expressionism	-	-	Like	1.4
Travel: visit culture	Agree	1.7	Disagr	1.7	Arts: surrealism	-	-	Like	1.0
Travel: hiking and trekking	-	-	Disagr	1.7	Doing sport	-	-	No	1.0
Doing sport	Yes	1.1	No	1.6	Going to a restaurant	-	-	No	0.9
Watching TV: VTM	-	-	Often	1.2					
Food: eating at home is the best	-	-	Agree	1.4					
Listening to music: opera	Once/wh	1.4	-	-					
Reading	Yes	1.4	No	1.2					
Attending concerts	Yes	1.3	-	-					
Total contribution: 63%		25%		38%	Total contribution: 56%		12%		44%

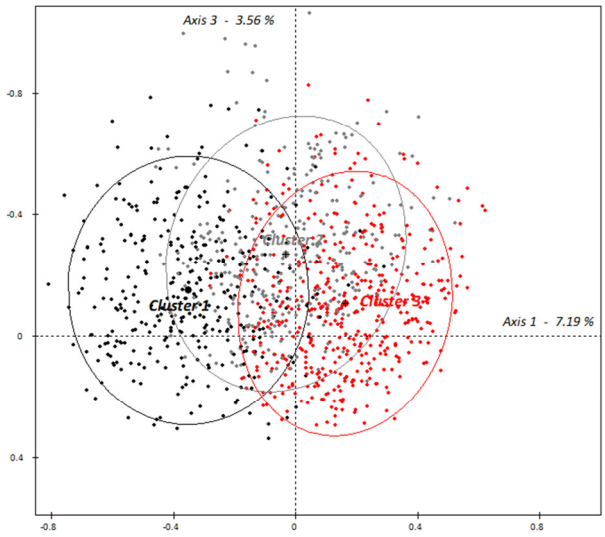
Graph 1. Modalities contributing more than average to axis 2 in plane 1-2 (left) and supplementary variables in plane 1-2 (right).



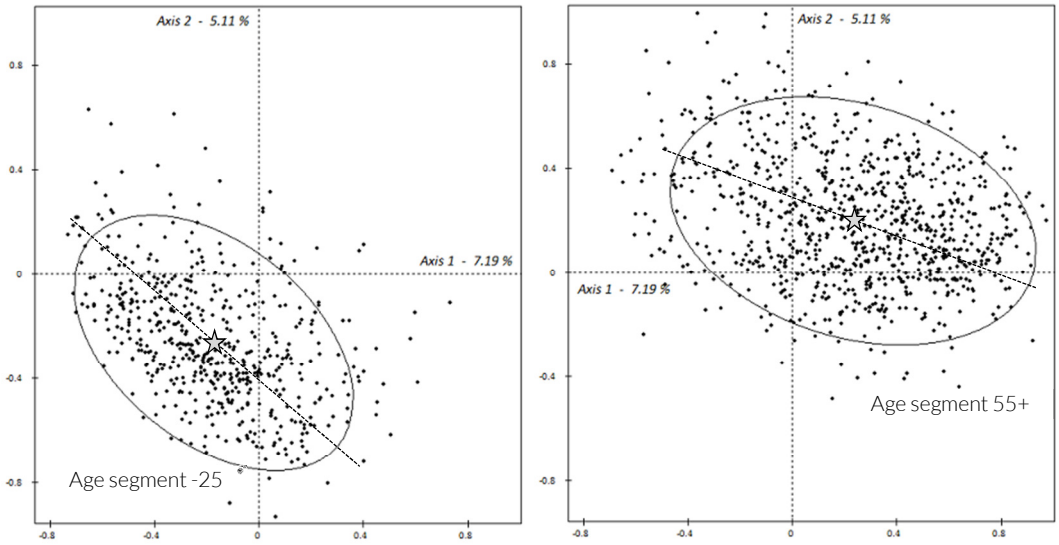
Legend: No/primary: no or primary education; LSE: lower secondary education; HE: higher education (college or higher); EGP I: managerial occupations; II: professions; III: intermediate occupations; IV: small employers and own-account workers; V: lower supervisory and technical occupations; VI: semi-routine occupations; VII: routine occupations.

Source: adapted from Roose *et al*., 2012.

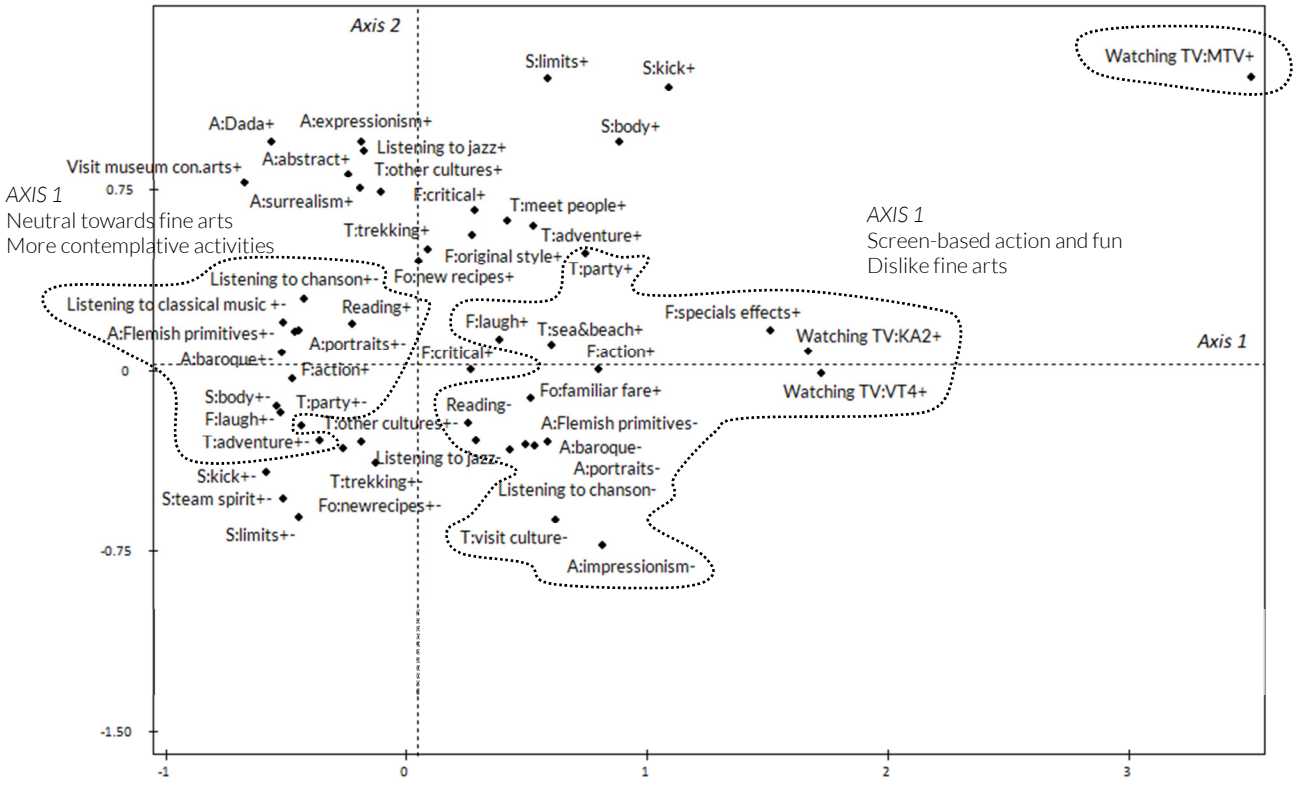
Graph 2. Three sub-clouds scoring high on axis three after hierarchical clustering in plane 1-3 (adapted from Roose *et al.*, 2012).



Graph 3. Sub-clouds of two age segments in principal plane 1-2 with mean points (grey asterisk) and concentration ellipses.



Graph 4. CSA of sub-cloud '14-25 years' with modalities contributing more than average to sub-plane 1-2.



Graph 5. CSA of sub-cloud '55-85 years' with modalities contributing more than average to sub-plane 1-2.

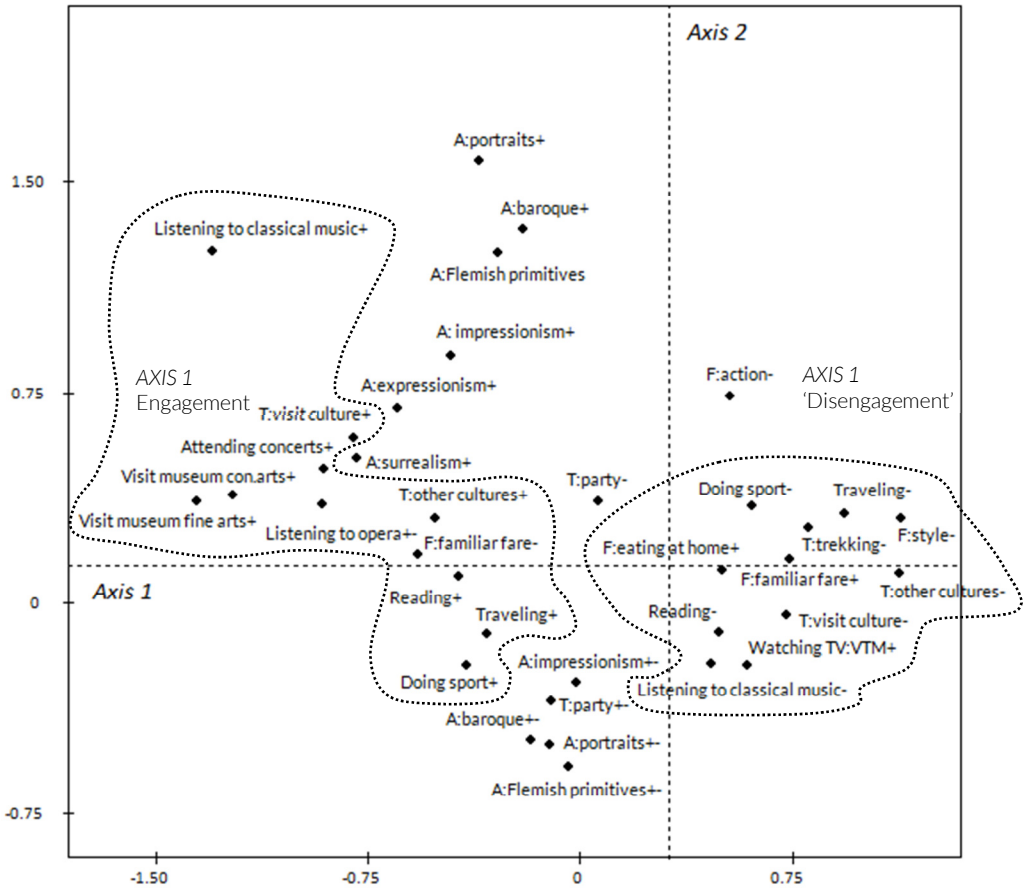


Table A1. Relative frequencies for participation variables (*n* = 2,849).

	Yes	No		Often	Once in a while	Never
Going to the movies	.472	.528	Listening to pop/rock	.539	.174	.286
Watching movies at home	.819	.181	Listening to dance	.342	.272	.384
Reading	.535	.465	Listening to folk/traditional music	.104	.360	.535
Reading: prose/poetry	.373	.627	Listening to chanson	.124	.411	.463
Reading: comics	.291	.709	Listening to jazz/blues/soul/funk	.120	.352	.526
Attending concerts	.141	.859	Listening to classical music	.118	.331	.550
Visiting museum fine arts	.154	.846	Listening to opera	.032	.148	.818
Visiting museum contemporary arts	.130	.870				
Shopping	.833	.167		0-1 hrs	2-3 hrs	4+ hrs
Going to a pub	.775	.225	Frequency watching television	.181	.483	.330
Going to a restaurant	.854	.146				
Doing sport	.604	.396				
Traveling	.740	.260				
Watching TV: TV1	.485	.515				
Watching TV: Canvas	.148	.852				
Watching TV: commercial station VTM	.316	.684				
Watching TV: KA2	.099	.901				
Watching TV: VT4	.111	.889				
Watching TV: Music channel	.062	.938				

Table A2. Relative frequencies for dispositional variables (*n* = 2,849).

	A[1]	N	DA		A	N	DA
Film3: "original in form and style"	.284	.529	.176	Food1: "do not spend much money"	.259	.508	.229
Film4: "makes you laugh"	.538	.399	.055	Food2: "good food important in life"	.371	.483	.145
Film7: "uses a lot of special effects"	.128	.473	.387	Food3: "familiar fare"	.357	.403	.240
Film9: "contains action & adventure"	.338	.502	.152	Food4: "try new recipes"	.428	.409	.163
Film10: "contains violent scenes"	.067	.330	.596	Food6: "steak and french fries"	.306	.367	.326
Film15: "is romantic"	.284	.542	.164	Food8: "eating at home is the best"	.438	.413	.147
Film20: "critical comment on society"	.146	.563	.280	Sport2: to change limits	.238	.403	.358
Arts1: (post-)impressionism[2]	.243	.551	.243	Sport4: team spirit	.326	.381	.293
Arts2: Flemish primitives	.249	.376	.372	Sport6: kick	.142	335	.522
Arts3: surrealism	.178	.389	.432	Sport7: a beautiful body	.190	.461	.348
Arts4: baroque portraits	.193	.435	.368	Sport8: friendship	.426	.408	.166
Arts5: abstract expressionism	.133	.349	.516	Travel3: meet new people	.287	.513	.189
Arts6: landscapes	.325	.480	.193	Travel4: sea & beach	.319	.421	.251
Arts7: conceptual art/Dadaism	.067	.300	.630	Travel5: visit culture	.240	.466	.283
Arts8: late-renaissance/baroque	.223	.416	.359	Travel9: party and fun	.230	.429	.333
Arts9: abstract art	.108	.340	.459	Travel11: adventure	.264	.440	.287
Clothing2: "new clothes every season"	.241	.361	.397	Travel14: other cultures	.339	.456	.196
Clothing4: "clothes reflect personality"	.371	.473	.152	Travel15: hiking and trekking	.353	.406	.231
Clothing5: "dressed properly"	.518	.351	.130				

[1] A=agree, N=neutral, DA=disagree or like, neutral, dislike.

[2] For 'Arts: …' respondents are shown three works considered 'iconic' for each style.

[i] I use a macro provided by Brigitte Le Roux, whom I want to thank for her willingness to share some of the intricacies of GDA with me. I am also grateful to my colleagues Frédéric Lebaron, Johs Hjellbrekke en Daan Vandenhaute who have been very helpful 'compagnons de route' in my explorations with GDA.